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Vol. 96 MARCH 28, 1942 No. 7

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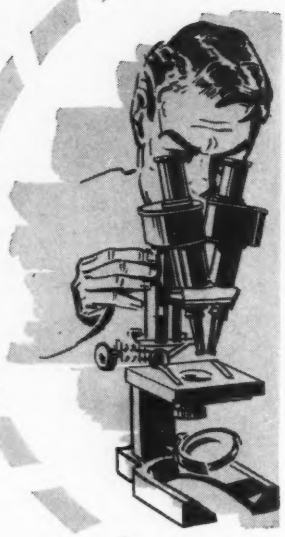

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Plant Culture and Nitrification Studies With Sludge-Acid Superphosphate

By B. E. BROWN, K. D. JACOB, and F. R. REID[1]

Introduction

SUPERPHOSPHATE is manufactured by mixing sulphuric acid with an approximately equal weight of finely ground phosphate rock. Although clear acid, averaging about 69.5 per cent H_2SO_4, ordinarily is used, limited quantities of spent acid from the refining of petroleum products are available for the manufacture of superphosphate in certain localities. In the earlier years of the petroleum industry, large quantities of this spent acid, commonly called "sludge" acid, were used in the manufacture of superphosphate. In recent years, however, some refineries have eliminated or curtailed the use of sulphuric acid, and others have installed equipment for the purification and recovery of the acid for re-use in their plants, with the result that the quantity of sludge acid available to the fertilizer industry has been greatly reduced. As indicated by a recent survey, the quantities of superphosphate made with sludge acid in 1940 and 1941 were equivalent to approximately 8,700 and 13,600 short tons, respectively, of 16 per cent material.

The acid sludge from petroleum refining consists principally of alkyl esters of the types $RHSO_4$ and R_2SO_4, which, when hydrolyzed with water or steam, yield a solution of sulphuric acid and a residue of hydrocarbons. The acid thus obtained, known as separated sludge acid, is dark in color, has a characteristic pungent odor caused by the presence of alkyl sulphuric acid, and usually contains about 40 to 60 per cent H_2SO_4. For the manufacture of superphosphate, the separated sludge acid is fortified with sufficient clear concentrated sulphuric acid to bring it to the required strength. Superphosphate made with this acid is darker than that made solely with clear acid, and it has the characteristic odor of the sludge acid. By further processing of the separated sludge acid, practically all the hydrocarbons can be removed by volatilization and charring; the product, as well as the superphosphate made therewith, is dark in color but has little or no offensive odor.

In some localities there appears to be a prejudice against the use of superphosphate made with sludge acid, possibly, for the most part, because of its color and odor and the disparaging sales arguments based thereon, as well as the use of the term "sludge-acid superphosphate." That this prejudice is justified does not appear to have been substantiated by plant-growth tests. Although the quantity of sludge acid now available for the manufacture of superphosphate is not large,[2] the demands of the war program for sulphuric acid for the production of explosives, steel, and numerous other essential materials, and the consequent dislocations in supplies of acid, make it desirable that the fertilizer industry utilize spent and waste acids to the fullest possible extent. Accordingly, a study of the fertilizing value

[1] Senior biochemist, Division of Fruit and Vegetable Crops and Diseases (Potato Investigations); senior chemist, Division of Soil and Fertilizer Investigations (Phosphate Section); and assistant soil technologist, Division of Plant Exploration and Introduction, respectively, Bureau of Plant Industry, U. S. Department of Agriculture.

[2] This statement refers only to the sludge acid available from the refining of petroleum products, such as lubricating oils, cylinder stocks, kerosene, gasoline, pressure distillate, etc. Large quantities of spent acid from the manufacture of so-called alkylation fluid will likely be available in the near future. Experiments to determine the suitability of this acid for the production of superphosphate are under way.

of superphosphate made with sludge acid was undertaken. The results of the greenhouse and laboratory tests are presented herein.

Results of Previous Investigational Work

Apparently very little experimental work has been done to evaluate sludge-acid superphosphate as a source of phosphorus for plants. In Russia, Kalinkin and Iakushkin[3] have reported that phosphorite treated with spent sulphuric acid from the manufacture of nitrotoluene and the purification of naphtha gave products which were equal in assimilability and efficiency to superphosphates prepared with acids from other sources.

W. J. Reid, Jr.,[4] in a study of the relation of fertilizers to seed-corn maggot injury to spinach seedlings, reported that a fertilizer containing sludge-acid superphosphate gave greater yields of spinach than similar material containing ordinary superphosphate. This effect may have been due in some measure to the repellent action of sludge-acid superphosphate toward the corn maggot.

Outline of Present Study

In order to determine the nutrient value of sludge-acid superphosphate in comparison with that of superphosphate made with clear sulphuric acid, vegetative pot tests were conducted under greenhouse conditions at the Arlington Experiment Farm, Arlington, Va. Also, laboratory experiments were made to determine the effect of sludge-acid superphosphate on the nitrifying organisms of the soil.[5] Four commercially produced sludge-acid superphosphates and a superphosphate made with clear sulphuric acid were employed in the study. Data on the composition and source of these materials are given in Table 1. The different superphosphates served as sources of phosphorus in nutrient mixtures containing nitrogen and potassium fertilizer materials. Details of the fertilizer treatments are as follows:

1. Soil used: Norfolk loamy fine sand, pH 5.4. Five kilos of soil used per pot.
2. Fertilizer analysis employed. 6-12-6.
3. Nitrogen derived equally from three sources: sodium nitrate, ammonium sulphate, and cottonseed meal.
4. Potassium derived from manure salts.
5. Rate of fertilizer application: 2,000 pounds per acre.
6. Method of applying fertilizer: Mixed with total quantity of soil by means of a mechanical mixer.

Details concerning the crop-plant indicators selected for the tests are as follows:

1. Crop plants used: Barley, millet, oats, and sorghum.
2. Number of plants (final stand in each pot): 10.
3. Number of replications: 3.
4. Total number of plants per treatment: 30.

Before attempting to set up a test with all the superphosphates and all crop plants, two preliminary tests were run. The first involved a comparison of clear-acid superphosphate, sample No. 1315, and a sludge-acid superphosphate, sample No. 1402, as sources of phosphorus in 6-12-6 fertilizer, millet being used as the indicator crop. The moisture-free crop weights recorded were 74.6 grams for the clear-acid and 75.2 grams for the sludge-acid superphosphate. This preliminary test showed that the two superphosphates were equally effective as phosphorus sources for millet. The second test was expanded to include the four sludge-acid superphosphates with millet again used as the indicator crop. Results are given in Table 2. Following the

(Continued on page 24)

[3] Kalinkin, S. I., and Iakushkin, I. V. "Superphosphate of different kinds in sand cultures." Ann. Inst. Agron. Moscow 19: 233-240 (1914). From abstract in Chemical Abstracts 8: 773.

[4] Reid, W. J., Jr. "Relation of fertilizers to seed-corn maggot injury to spinach seedlings." Jour. Econ. Entom. 29: 973-980 (1936).

[5] In addition to the greenhouse and laboratory studies, it is planned to compare the two types of superphosphate as sources of phosphorus in fertilizers under field conditions, the tests to be made on potatoes in a number of widely separated sections.

Table 1.

Composition of Florida Pebble Superphosphates Used in Greenhouse and Laboratory Tests

Sample No.*	Type of sulphuric acid used in making the superphosphate	P_2O_5 Total Per cent	P_2O_5 Water-soluble Per cent	P_2O_5 Available Per cent
1315	Clear	19.20	16.70	19.08
1402	Separated sludge	20.60	19.06	20.03
1403	Processed sludge	20.56	20.19	20.32
1405	Separated sludge	19.54	17.63	19.30
1414**	Separated sludge	17.85	16.50	17.72

* The numbers are those assigned to the samples by the Phosphate Section, Division of Soil and Fertilizer Investigations, Bureau of Plant Industry.

** This sample was from material that had been stored in a tightly stoppered container for about 7 years; the other samples were from freshly made materials.

War Emergency Conferences

New Orleans

THE War Emergency Conference for agricultural and fertilizer industry leaders held at New Orleans on March 9th was attended by fully 75 persons representing State and Federal agricultural agencies and the fertilizer industry of the territory. Among those in attendance were the Commissioners of Agriculture of five Southern States—J. Roy Jones of South Carolina, Tom Linder of Georgia, Haygood Paterson of Alabama, Si Corley of Mississippi, and Harry D. Wilson of Louisiana. Dr. G. S. Fraps, State chemist of Texas, was present, as were also representatives of the agricultural colleges of Arkansas, Louisiana, and Mississippi; Prof. Robert M. Salter of the U. S. D. A.; Dr. H. B. Boyd and E. L. Deal of A. A. A.

The first speaker was T. E. Milliman, Office of Price Administration, who outlined the policies and objectives of OPA with respect to fertilizer prices and answered many questions from the floor. John J. Scott, OPA attorney, explained Temporary Price Regulation No. 1 and discussed the Price Control Act. Dr. H. B. Boyd, director of the Division of Special Programs, AAA, described the methods employed in arriving at the present agricultural goals; and E. L. Deal, Program Operations Section of AAA, brought a message from Dr. I. W. Duggan, director of the Program Division, urging that nitrate of soda should be distributed equitably to all farmers who use it.

At the afternoon session Charles J. Brand presented a brief statement prepared by the American Potash Institute which indicated that potash supplies are adequate to meet all fertilizer needs, barring transportation or other difficulties. S. B. Haskell, The Barrett Division Allied Chemical & Dye Corp., and Nelson Myers of Chilean Nitrate Sales Corp., made brief statements concerning nitrate supplies and their allocation to members of the fertilizer industry by the War Production Board. Dr. P. H. Groggins, Office of Agricultural Defense Relations, explained the methods being employed in the distribution of nitrate of soda to farmers; the present situation with respect to nitrate of soda, sulphuric acid, superphosphate, and arsenicals. H. R. Smalley made a brief statement concerning reduction of grades and elimination of filler in the States represented at the conference. T. E. Milliman stated that the fertilizer industry has an opportunity to go still further in the elimination of filler and urged that this be done. There was much discussion from the floor, many questions being asked and answered, and everyone felt that the meeting had been very helpful.

Atlanta

Fully 160 persons attended the War Emergency Conference which was held in Atlanta on March 10th. Representatives of the agricultural colleges, State war boards, State department of Agriculture, AAA, and of the fertilizer industry in Georgia, Florida, Alabama, and Tennessee were in attendance. Mr. Brand presided and introduced a number of the representatives of State and Federal agencies. T. E. Milliman, Office of Price Administration, outlined the price regulation policies of the OPA and paid tribute to the nitrogen, superphosphate, potash, and mixed fertilizer producers for having supplied fertilizer at reasonable prices. John Scott, OPA attorney, discussed Temporary Price Regulation No. 1 as to its meaning, application, and prohibitions, and he also outlined the compliance organization that is being set up in OPA. J. A. Woods, Chilean Nitrate Sales Corp., discussed the nitrogen situation and emphasized the fact that we are fortunate in having obtained as much Chilean nitrate as has been delivered or is in prospect. He emphasized that explosives come first, that some nitrate has been allocated to the West Coast for agricultural use and for powder manufacture, and some has been set aside to meet special situations.

S. B. Haskell, The Barrett Division, Allied Chemical & Dye Corp., outlined the present nitrogen picture and compared it with that of 1917-18. During the latter years we had less than one-third as much sulphate of ammonia as this year, and the present wholesale price is about one-third that of 1917-18. Distribution of nitrate of soda is in the hands of the Government, and the nitrogen companies are distributing it in accordance with instructions received from the War Production Board.

H. B. Mann, American Potash Institute, made a brief statement indicating that potash supplies will be adequate barring transportation or other difficulties. P. H. Groggins, Office of Agricultural Defense Relations, discussed the superphosphate and sulphuric acid situa-

(Continued on page 18)

Fertilizer Papers at American Chemical Society Meeting

THE Division of Agricultural and Food Chemistry, American Chemical Society, has announced the program for the meetings of the Division during the Spring Convention of the Society, which will be held at Memphis on April 20 to 24, 1942. Meetings of the Division will be held on April 21st, 22nd and 23rd. The following are abstracts of those papers which have to do with fertilizer problems:

The Effect of Some Minor Element Compounds on the Yield and Mineral Content of Oats, Wheat, and Potatoes

J. S. McHargue, R. H. Hageman, G. D. Sherman, W. S. Hodgkiss and E. S. Hodge

(To be presented April 21st, 2.50 P. M.)

The purpose of this investigation is to ascertain the effect of certain minor element compounds on the yield and mineral content of some important farm crops and vegetables.

A badly depleted, sandy, silt loam soil was selected for pot and field experiments. Preliminary pot culture experiments with the soil indicated that it was deficient in both major and minor chemical elements. Plots of soil one-fortieth of an acre in area were measured and staked in the field, and were fertilized as follows: check plots, manure, manure and minor elements, major elements only, and applications of major and minor element compounds. Oats were the first crop grown. The yield of mature seed oats ranged from 12.5 bushels per acre on check plots to 56.4 bushels per acre on the plots that received 800 pounds of superphosphate and 800 pounds of potassium sulphate per acre.

Chemical and spectrographic analyses were made on the grain and straw of the oat crop.

Wheat was sown on the same plots in the fall of 1940 without the addition of any further fertilizers. The application of major and minor element compounds to the soil produced increases in the yield of wheat. The composition of the grain and straw was also affected. However, on some of the plots, too heavy applications of minor element compounds were made, and toxic effects on the growth of the crops resulted.

During 1941 a crop of Irish potatoes was grown on an adjacent plot of the same soil. The potatoes were planted in thirty-foot rows and each ten-foot section of the rows alternated with treated and untreated portions. The ten-foot section of the row which was fertilized with twenty-five pounds of stable manure produced the largest yield of potatoes. However, combinations of certain major and minor element compounds produced yields which were only slightly less than the section fertilized with manure. Chemical and spectrographic analyses were made on a composite sample of the unfertilized potatoes and also on the potatoes that were fertilized.

Fertilizers and Cropping Systems as Affecting Cotton Yields in Alabama

D. G. Sturkie, Alabama Agricultural Experiment Station, Auburn, Ala.

(To be presented April 22nd, 3.10 P. M.)

Cotton is still the major source of income to the Alabama farmer. The acreage has been reduced from a little over 4 million acres in 1914 to approximately 2 million in 1941. The production of cotton has not declined in proportion to the decrease in acreage. At present Alabama produces around a million bales of cotton. The decrease in acreage resulted in the use of the more fertile soils for cotton, use of more fertilizer per acre, and the adoption of soil-improving practices which have resulted in increased production per acre. In 1911 extensive fertilizer tests were begun in cooperation with farmers on the various soil types in the State. These tests resulted in the socalled "Auburn method of fertilization" which consisted of a minimum application of 325 lb. of fertilizer, made from 200 lb. of superphosphate, 100 lbs. of nitrate of soda, and 25 lb. of muriate of potash, and a maximum application of twice this amount. Further research has shown that other materials may be used and the ratio of N to P to K now recommended is 6-8-4. This fertilizer should be made from superphosphate, almost any source of nitrogen (provided the acidity is neutralized), and muriate of potash. If triple superphosphate is used the nitrogen should be sulphate of ammonia. A fertilizer should not be completely free of sulphur in Alabama.

In some few cases the need for so called "rare elements" is found. Magnesium may be

deficient on some very sandy soils. On soils that are very sandy the need for additional potash is sometimes evident. With the coming of the war the use of nitrogen in fertilizers is very limited. It will probably become more limited as the production of munitions increases. This shortage may be partly offset by the use of legumes. The results of rotation studies have shown that large yields of cotton may be obtained following the growth of a winter legume such as crimson clover or vetch.

The Effect of Source on Magnesium Absorption by Tobacco

T. R. Swanback, Connecticut Agricultural Experiment Station, Windsor, Conn.

(To be presented April 22nd, 3.40 P. M.)

The field experiment discussed in this paper was mainly an attempt to decide whether magnesian hydrated lime or magnesian limestone (dolomite) is the most effective source of magnesia for tobacco in the same season as the materials are applied. For comparison a neutral mixture of landplaster (calcium sulphate) and Emjeo (an anhydrous magnesium sulphate) was included carrying the equivalent amounts of CaO and MgO. Control plot was also included and entire field was fertilized with an 8-4-8 mixture. Relative values of crop (Havana Seed tobacco) return (including yield and quality) were as follows:

Control	= 100
Neutral mixture (see above)	= 103.2
Hydrated magnesian lime	= 111.5
Magnesian limestone	= 133.1

Soil tests (Morgan method) revealed that all the magnesia in the "neutral mixture" and the limestone was replaceable while hydrated lime was not so effective. The lowest nitrate nitrogen content occurred in soil receiving neutral mixture.

Chemical analyses of tobacco showed a somewhat higher deposit of magnesia in the leaf where hydrated lime had been used than in the case of limestone. Highest CaO and MgO deposits were due to the mixture landplaster-Emjeo. It was concluded that both the hydrated form and the limestone may be used to equal advantage, although preference may be given to the limestone since it can be used in any mixture.

The Fluorine Content of Certain Plants as Affected by Various Fertilizer Treatments

W. H. MacIntire, S. H. Winterberg and J. G. Thompson, University of Tennessee Agricultural Experiment Station and Tennessee Valley Authority, Knoxville, Tenn.

(To be presented April 23rd, 3.10 P. M.)

It is known that potable waters of abnormal fluoride content induce fluorosis in adolescents and that continued feeding of rock phosphate is detrimental to livestock. The present results stem from a study as to whether fertilizer incorporations affect the fluorine content of forage crops and ground waters.

Nine of the ten successive greenhouse crops —sudan grass, red clover, radishes—showed a no percentage increase in fluorine uptake from incorporations of calcium silicate slag of 2.3 per cent fluorine content at per acre rates of 5, 10, 20, and 40 tons $CaCO_3$-equivalence in a Montevallo soil. In a similar experiment, plants grown on a Paden soil showed no increase in fluorine content from 400-pound and 665-pound additions of calcium fluoride supplied by 3- and 5-ton incorporations of slag.

Sudan grass from two variously phosphated Hartsells and Fullerton soils in outdoor concrete frames showed no enhancement in fluorine-uptake results were obtained when these soils were treated as in the frames and used for greenhouse cultures of sudan grass and radishes.

These findings, and those from related studies in which additive fluorine was supplied by various phosphatic materials, gave no indication that economic additions of fluorine-bearing phosphatic fertilizers induce an appreciable increase in the fluorine content of forage crops.

CALLISTER APPOINTED CANADIAN ASSISTANT FERTILIZER ADMINISTRATOR

Appointment of George J. Callister of Beamsville, Ontario, as Assistant Administrator of Fertilizers and Pesticides under the Agricultural Supplies Board was announced by the Board on March 14th.

Prior to settling at Beamsville a few years ago to take up farming, Mr. Callister spent many years in promoting the scientific and practical use of fertilizers throughout North America. He was perhaps best known as Vice-President and Secretary of the American Potash Institute, Washington, D. C., which has sponsored a fertilizer program in Canada for many years.

Mr. Callister has taken up his duties in Ottawa in connection with the administration of the fertilizer subvention policy in the five Eastern provinces and in allocating supplies of fertilizers, and chemicals used in pest control work in the Dominion. His address will be Room 632, Confederation Building, Ottawa.

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Fertilizer Anti-Trust Suit Settled

The fertilizer anti-trust suit, which, with the preliminary investigation, was under way for more than three years, was terminated on March 24th in the Federal Court at Winston-Salem, North Carolina.

Originally there was 102 defendants—two trade associations, 64 fertilizer companies, and 36 officials of the defendant corporations.

The defendants, except seven as to whom the case was nol-prossed, entered pleas of "nolo contendere," which means "I will not contest." Defense attorneys pointed out to the Court that defendants did not enter the pleas out of any sense of guilt but largely because of war emergency conditions and demand upon their time and energies. Judge Johnson J. Hayes commended the attorneys on both sides for reaching a solution of the case that did not involve a long and expensive trial, and ordered that a hearing be held for the purpose of taking testimony to give him information as to business operations in the industry and the issues involved in the suit. These hearings extended from March 16th to March 24th, when the judgment of the Court was rendered.

The defendants who were nol-prossed are: Arkansas Fertilizer Company, F. W. Tunnell & Company, Inc., Harold F. Ayer, John F. Maybank, A. Quistgaard Petersen, E. H. Westlake, and George A. Whiting. In addition to these the Court imposed no penalty upon Charles J. Brand, Executive Secretary of The National Fertilizer Association, saying that there was no evidence to indicate any intention whatever on his part to violate the law in letter or spirit. Fines imposed on corporations range from $500 to $9,000 and on individuals from $2.00 to $4,000, aggregating about $255,000.

Among industry practices under attack were the exchanging of price schedules and port basing-point prices. It was pointed out to the Court that Government publications show that these practices are nothing new in the industry but have been in existence for many years.

The settlement of the suit did not include entry of any consent decrees as to future business practices in the industry.

The Quick-Acting Victory Brand Fertilizer —War Savings Bonds.

Wickard Comments on Intentions to Plant

Secretary of Agriculture Claude R. Wickard today made the following comment on the March 24th report of the Crop Reporting Board on Prospective Plantings for 1942:

The nation has every reason to be encouraged by yesterday's report on what farmers intend to plant this year.

Already there had been substantial increases in production of eggs, meats, and milk. Now there is evidence that farmers plan great increase in the crops which the nation needs, and that they are carrying out in a single year sweeping shifts in operations which ordinarily would require several years.

Given normal weather, the goals for several products probably will be exceeded. For a few crops, the prospective acreages are below the production goals. But the over-all picture is good. Even since March 1st, when the data on farmers' plans were gathered there probably have been increases in acreage to be planted to some of the crops which now appear to be on the low side, and there still is time for further increases.

Of course, planting the acreage needed is only the first step. We shall still be faced with troublesome problems of getting labor, getting machinery, and getting fertilizers and spray materials to bring the yield per acre up to or above normal. And after the yield is obtained there will be another series of difficulties in transporting the products to market, creating new markets for the great expansion in some lines, obtaining processing equipment, and finding storage space. We are working at these problems in collaboration with the War Production Board and other agencies.

Crop	Planted Acreages (in thousands) Average 1930-39	1941	Indicated 1942
Corn, all	101,081	87,164	91,348
All spring wheat	21,762	16,741	15,287
Durum	3,418	2,597	2,201
Other spring	18,344	14,144	13,086
Oats	39,196	39,363	40,377
Barley	12,713	15,080	18,208
Flaxseed	2,406	3,367	4,037
Rice	943	1,257	1,454
All sorghums	12,157	18,169	17,070
Potatoes	3,365	2,793	2,814
Sweet potatoes	882	759	776
Tobacco	1,676	1,350	1,446
Beans, dry edible	1,942	2,304	2,412
Soybeans[1]	5,467	9,996	14,085
Cowpeas[1]	2,647	3,780	3,898
Peanuts[1]	1,951	2,498	4,150
Tame hay[2]	56,102	59,232	60,831
Sugar beets	883	795	983

[1] Grown alone for all purposes. Partly duplicated in hay acreage.

[2] Acreage harvested.

I have asked the Department's men to analyze the report on prospective plantings so that we can have the best possible interpretation of what trends for individual crops mean and the best basis for studying any steps this Department might take to encourage further acreage increases that seem advisable.

But even before that analysis is made, I can point out a few very interesting things in the report. One is the large increase indicated in rice acreage—over 15 per cent above last year's planted acreage whereas the goal called for an increase of 6 per cent.

As to feed grains, the intentions indicate a total acreage well in line with the goals or suggested acreages. The indicated increase of 21 per cent in barley acreage offsets the indication of an increase in corn acreage of but 5 per cent instead of the 8 per cent requested.

For the oil crops which are so badly needed, the fact that March 1st intentions to plant were short of the goals for peanuts and flaxseed is in part offset by the fine report on soybeans. If 4 million acres are grown for hay this year, as was the case last year, about 10 000,000 acres would be harvested for beans. The goal for this year is 9 million acres. Intentions to plant both peanuts and flaxseed mark great increases over last year, even though they are not up to this year's goals. For peanuts, as the report points out, increases in intentions to plant probably have occurred since March 1st. At that time many farmers still had not learned details of the price support program for peanuts.

This is true of potatoes as well. On March 1st farmers intended to plant an acreage slightly larger than last year's, instead of making the 10 per cent suggested increase. Since then, on March 4th, the program to encourage farmers to plant their full acreage allotments was announced, and we believe farmers' plans for planting have been stepped up.

(Continued on page 22)

BUHNER GIVEN DEFENSE POST

Recently appointed as chief of the service and operations section of the Office of Defense Transportation, Ed. J. Buhner, President of Silver Fleet Motor Express, Inc., left for Washington on March 15th. Mr. Buhner is also Secretary and Treasurer of the Buhner Fertilizer Company, Seymour, Indiana.

The appointment, made in Washington, where Mr. Buhner took up his new duties on March 16th, was announced by Commissioner

John L. Rogers, Director, Division of Motor Transport, of ODT. Mr. Buhner has been granted six months' leave of absence from Silver Fleet, with the understanding it will be extended as long as he is needed by the Office of Defense Transportation.

The Motor Transport Division of the Office of Defense Transportation is divided into five sections. Besides the service and operations section, the other sections are: Maintenance, allocation of equipment, statistical, and passenger bus sections.

January Superphosphate Production Increases

January superphosphate production in plants of reporting acidulators was the largest for any January in recent years, according to the monthly compilation of The National Fertilizer Association. Production totaled 430,800 tons, only slightly less than for the month of December. The trend of production has been upward since last June, while the usual sharp seasonal decline from January through July was not in evidence in 1941.

Production in both areas was moderately higher than a year ago, with an increase of 28 per cent in the North and a 27 per cent rise in the South. Aggregate output in the first seven months of the current fiscal year, from July through January, exceeded production in the comparable period of last year by 20 per cent. During this period the gain was more pronounced in the South than in the North.

Stocks of bulk superphosphate were slightly higher than in December, following the usual seasonal trend. Compared with January 1941, however, stocks were somewhat smaller, with decreases reported by both areas. Contrary to the usual seasonal pattern stocks in base and mixed goods fell off by 25,000 tons during January.

Superphosphate Production, Shipments, and Stocks for January and July-January, 1942 and 1941

Expressed throughout in equivalent tons of 16% A.P.A. Based on reports by acidulators to The National Fertilizer Assn.*

January	United States 1942	United States 1941
Stocks—First of month:		
Bulk superphosphate	911,013	1,106,769
Base & mixed goods	751,130	678,676
Production:		
Bulk superphosphate	421,799	330,769
Base & mixed goods	9,011	7,777
Total Production	430,810	338,546
Other Receipts†	50,330	51,236
Book Adjustments	+1,403	—237
Total Supply	2,144,686	2,174,990
Shipments:		
Superphosphate:		
To mixers	128,049	112,260
To other acidulators	54,448	35,089
To consumers, etc.	61,670	46,039
Total Superphosphate	244,167	193,388
Base & mixed goods	114,407	38,420
Total Shipments	358,574	231,808
Stocks—End of month:		
Bulk superphosphate	951,555	1,083,209
Base & mixed goods	834,557	859,973
Total Stocks	1,786,112	1,943,182

Accumulated Production and Shipments for July-January

	United States 1941-42	United States 1940-41
Production:		
Bulk superphosphate	2,538,904	2,193,525
Base & mixed goods	65,233	58,327
Total Production	2,604,137	2,251,852
Shipments:		
Superphosphate:		
To mixers	760,306	681,153
To other acidulators	385,366	272,355
To consumers, etc.	498,741	353,994
Total Superphosphate	1,644,413	1,307,502
Base & mixed goods	448,055	330,135
Total Shipments	2,092,468	1,637,637

* Represents approximately 85 per cent of total production.
† Includes inter-company transfers.
Base includes wet and/or dry base.

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1253 West Beaver Street
Jacksonville, Fla.

FERTILIZER MATERIALS MARKET

NEW YORK

Permanent Price Ceilings Placed on Nitrate of Soda, Sulphate of Ammonia and Cyanamid. Early Deliveries of Mixed Fertilizers Heavy. Ample Supplies of Potash Estimated.

Exclusive Correspondence to "The American Fertilizer."

NEW YORK, March 24, 1942.

Late in February, price ceilings were established on mixed fertilizers and fertilizer materials for sale to consumers, which price ceilings were effective for 60 days.

Last week price ceilings were placed by the Office of Price Administration on sales of nitrate of soda, sulphate of ammonia and cyanamid, which ceilings are permanent. These ceilings also apply against sales to the consumers.

Mixed fertilizers, in many parts of the country, have been moving to the consumer very rapidly so that in many instances deliveries already made are out of proportion, against previous years, to the anticipated 25 to 30 per cent increase in the use of mixed fertilizers. In other words, in some parts of the country the farmers have already received a large share of mixed fertilizers which they expect to use during the present season.

There has been no easing in the demand for sulphate of ammonia, potash and superphosphates.

Certain figures have been compiled, estimating that there will be 615,000 tons of K_2O during the next fertilizer year against an estimated need of 590,000 tons but these figures do not take into consideration the possibility of shipping potash against the Lend-Lease. Further, the general feeling is that the anticipated production might be curtailed by any one of many possibilities.

AAA FERTILIZERS IN 1941

During 1941, distribution of AAA grants-of-aid in lieu of cash payments earned by compliance with the Soil Conservation program amounted to 95,279 tons of concentrated superphosphate, 728,318 tons of 20 per cent superphosphate and 9,773,384 tons of liming materials.

BALTIMORE

Ceiling Established on Some Fertilizer Chemicals. Nitrate of Soda Allocations Less Than Expected. Higher Superphosphate Prices Expected.

Exclusive Correspondence to "The American Fertilizer."

BALTIMORE, March 24, 1942.

Since last report the O. P. A. has placed ceiling prices on nitrate of soda, sulphate of ammonia and cyanamid, applicable to fertilizer manufacturers, dealers and consumers effective March 23, 1942.

Ammoniates.—The market continues firm at previously quoted levels, with ground animal tankage being quoted on basis of $6.60 per unit of nitrogen and 10 cents per unit of B.P.L., f.o.b. northern production points, with ground dried blood being offered on the same basis, but very little interest being shown as far as fertilizer manufacturers are concerned.

Nitrogenous Material.—The market on this ingredient is ruling slightly higher, and is nominally about $4.50 per unit of nitrogen, f.o.b. Baltimore.

Sulphate of Ammonia.—Under Governmental regulations cash sales by mixers to consumers are not to exceed original cost price plus actual transportation charges, plus $4.00 per ton, in bulk, with additional $1.50 per ton for bagging, plus cost of bags; to dealers $2.00 per ton less, but in the latter case dealers' price to consumers will only be $2.00 per ton more than paid by the dealer.

Nitrate of Soda.—The ceiling on this commodity shows the same spread as in the case of sulphate of ammonia. Allocations for the month of March to manufacturers in this section were below expectations, and manufacturers are hoping and anticipating more liberal allocations for the month of April. In the meantime the market remains unchanged at previously quoted levels.

Fish Meal.—The market on fish meal con-

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It's a war job we've got to do—to help keep 'em growing—to help farmers produce the huge crops America needs. To serve you and those who depend on you, *International* is mining and manufacturing a large line of fertilizer materials of uniform quality and excellent mechanical condition, including:

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Superphosphate — Multiple Superphosphate

American Potash Salts

A Complete Line of all Grades of Potash
Including SUL-PO-MAG
(Sulphate of Potash-Magnesia)

Florida Pebble Phosphate Rock
68%—70%—72%—75%—77%

Tennessee Phosphate Rock
66%—68%—72%—75%

Sodium Silico-Fluoride

Complete Fertilizers

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MINERALS & CHEMICAL *Corporation*

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tinues unchanged at $72.50 for 60 per cent grade, in bags, f.o.b. Baltimore.

Superphosphate.—It is reported there was a recent sale at $10.00 per ton, basis 16 per cent for run-of-pile, which is equivalent to $10.50 for flat 16 per cent grade, in bulk, f.o.b. Baltimore. In view of the increased cost of production due to higher freight rates, it would not be surprising to see higher market for another season.

Bone Meal.—There is very little interest being shown in the market either on raw or steamed bone meal, and prices remain strictly nominal.

Potash.—There have been no re-sales reported, as all manufacturers are conserving their supplies to take care of their current season's requirements.

Bags.—Manufacturers are resorting to paper and second-hand bags to replace new bags which they are unable to secure due to the Government requisitioning burlap.

CHARLESTON

Shipments of Mixed Goods Very Far Ahead of Last Season to Date. Organic Materials Scarce.

Exclusive Correspondence to "The American Fertilizer."

CHARLESTON, March 24, 1942.

The heavy movement of mixed goods still continues and the total of shipments so far this season is still very, very for ahead of the same date last season.

Nitrogenous.—Supplies of this material are still scarce. The market is around $3.30 per unit of ammonia ($4.01 per unit N), f.o.b. western points; $3.70 per unit of ammonia ($4.49½ per unit N), ex vessel southeastern ports, prompt if any left.

Blood.—Is quoted around $5.30 per unit of ammonia ($6.44 per unit N), c.i.f. ports, but shipments are practically impossible on account of lack of vessel space. Chicago market, $5.80 per unit of ammonia ($7.05 per unit N).

Fish Meal.—This material is at present unobtainable.

Cottonseed Meal.—The 8 per cent grade is priced at $42.00, Atlanta; $37.00 to $37.50, Memphis; $41.50, Augusta. The Augusta price for 7 per cent meal is $38.50.

Superphosphate.—No offerings are in the market.

TENNESSEE PHOSPHATE

Spring Weather Aids Preparation for Crops. Phosphate Rock Production Proceeding at Increased Rate.

Exclusive Correspondence to "The American Fertilizer."

COLUMBIA, TENN., March 23, 1942.

Spring came with the calendar and with one of the heaviest wind and rainstorms experienced in these parts for many days, and it now looks as if the farmers would soon get caught up. Tobacco beds are flourishing over many parts of the area; land is prepared for early potato planting and preliminary preparation for corn planting is in evidence.

The Federal Chemical Co., is reported as having started on its Williamson County lands between West Harpeth and Thompsons Station. Cars are being loaded and transported by rail to its Mt. Pleasant milling plant to be washed and dried for shipment to its various superphosphate plants in Tennessee, Kentucky, Mississippi and Ohio.

The Hoover & Mason 50 per cent increase of grinding capacity got into regular operation about March 18th, and while sadly delaying the March shipments scheduled for the Ruhm Phosphate Co., they are now rapidly catching up with these as well as with the heavy orders from AAA for Illinois sales of that organization.

Manufacturers' Sales Agents for **DOMESTIC**

Sulphate of Ammonia

Ammonia Liquor :: Anhydrous Ammonia

HYDROCARBON PRODUCTS CO., INC.

500 Fifth Avenue, New York

While competing sellers of rock phosphate for direct application are not covered up with such a flood of unfilled orders carried over from 1941, all report the largest business ever enjoyed and it will be beyond question necessary for larger capacity in this line by all producers.

CHICAGO

Limited Offerings of Fertilizer Organics with Little Carry-over Expected. Ceiling Prices on Feed Materials Reduced.

Exclusive Correspondence to "The American Fertilizer."

CHICAGO, March 23, 1942.

Trade in organics has been narrow, owing principally to limited offerings. Carry over, if any, this season will be extremely small. Inquiry for summer and fall shipments are in the market, but, as far as can be ascertained, no offerings have been made as yet.

Ceiling prices of meat scrap and digester tankage are reduced, effective March 26th, by $5.00 and $6.00 per ton respectively. Business in wet and dry rendered tankage is at a standstill at this writing; traders prefer waiting results of the new ceilings.

Nominal prices are as follows: High grade ground fertilizer tankage, $4.00 to $4.25 ($4.86 to $5.16½ per unit N) and 10 cents; standard grades crushed feeding tankage, $5.75 to $5.80 ($6.99 to $7.05 per unit N) and 10 cents; blood, $5.65 to $5.75 ($6.87 to $6.99 per unit N); dry rendered tankage, $1.20 to $1.27½ per unit of protein, Chicago basis.

FERTILIZER RECOMMENDATIONS FOR ONTARIO

Through the courtesy of Professor Henry G. Bell, secretary of the Ontario Advisory Fertilizer Board, we have received a copy of an attractive 48 page pamphlet which gives the recommendations of the Board for soil management and the use of fertilizers in 1942. This booklet is a valuable guide for every farmer in the province as it covers practically every crop grown in that section of Canada. Among the crops for which specific recommendations are made are cereals, vegetables, sugar beets, pastures, orchards, berries, and tobacco.

In making fertilizer recommendation, the Board has confined its choices to 15 general analyses and 6 special tobacco mixtures. The analyses recommended are as follows:

	For general use	
10-6-4	2-16-6	2-8-10
4-12-6	2-12-10	0-16-6
4-8-10	2-12-6	0-12-15
4-8-6	2-8-24	0-12-10
3-10-5	2-8-16	0-12-6
	For tobacco	
4-8-10	3-10-8	2-12-6
4-8-6	2-12-10	2-10-8

P. D. PETERSON NAMED DIRECTOR OF FREEPORT AGRICULTURAL RESEARCH

Dr. Paul D. Peterson has been appointed Director of Agricultural Research for the Freeport Sulphur Company to head the company's development of new agricultural uses of sulphur, Langbourne M. Williams, Jr., president, announced on March 21st.

Dr. Peterson has specialized in research on agricultural uses of sulphur for the past 10 years. His experience includes work with Freeport, the Crop Protection Institute, the Office of Cereal Crops and Diseases of the Department of Agriculture, and the Koppers Company. He holds bachelor and doctor degrees from the University of Minnesota, and he has taught plant pathology there and at Cornell. His headquarters will be in the New Orleans office.

PULVERIZED MASCOT LIMESTONE
Trade Mark Registered

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"It's a Dolomite"
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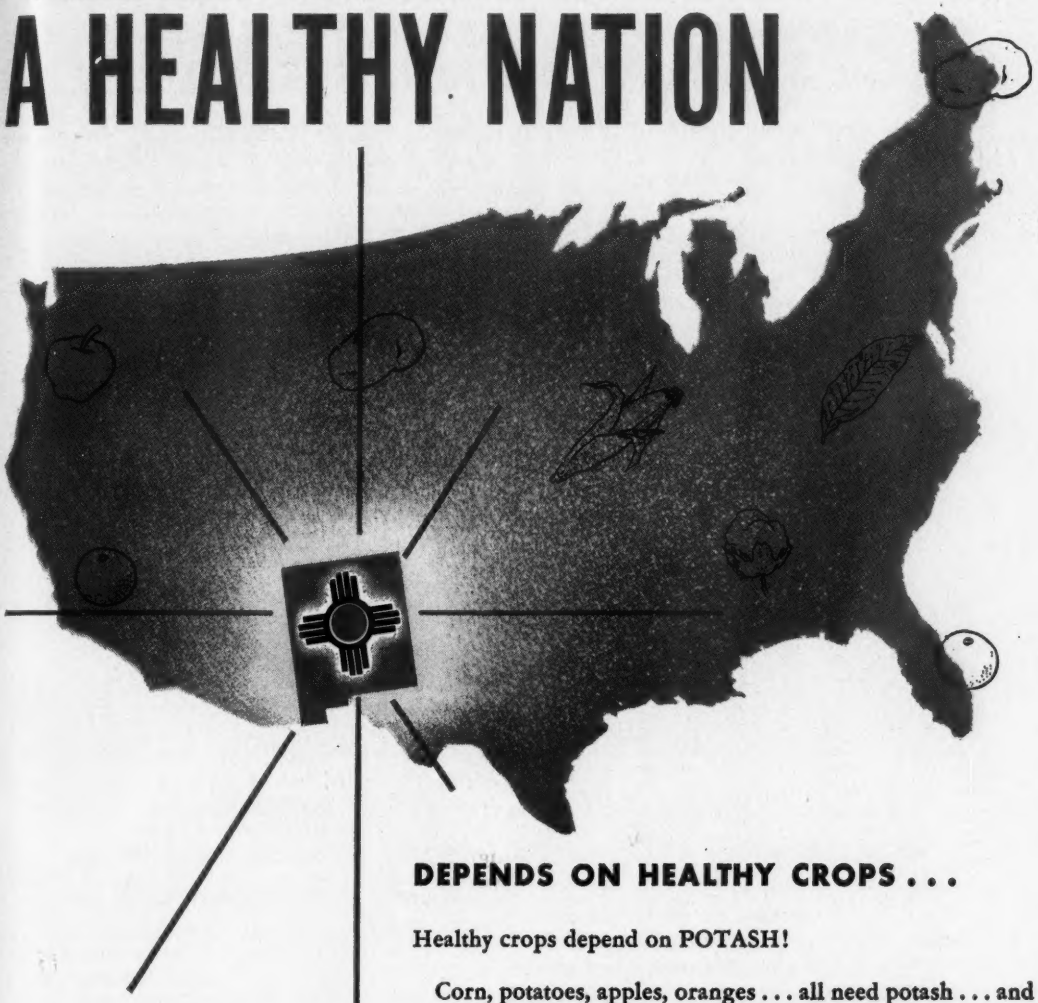
A HEALTHY NATION



DEPENDS ON HEALTHY CROPS . . .

Healthy crops depend on POTASH!

Corn, potatoes, apples, oranges . . . all need potash . . . and without it do not mature properly. Enough potash for corn assures the farmer of full ears of high feed value . . . prevents firing of the leaves and lodging. The potato plant, amply fed on potash, more easily resists pests, disease and drought . . . gives the grower more "No. 1's" per acre. Fruit trees also thrive when fertilized with a mix that includes the right proportion of potash. This vital plant food imparts vigor to the trees . . . improves the keeping quality of the fruit.

SUNSHINE STATE POTASH, mined in New Mexico, can be depended upon by fertilizer manufacturers because of its uniform analysis and careful sizing which makes blending easy.

HIGRADE MURIATE OF POTASH
62/63% K_2O
Also 50% K_2O Grade
MANURE SALTS
22% K_2O Minimum
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SUNSHINE STATE POTASH
A PRODUCT OF NEW MEXICO U.S.A.

UNITED STATES POTASH COMPANY, *Incorporated*, 30 ROCKEFELLER PLAZA, NEW YORK

WAR EMERGENCY CONFERENCES

(Continued from page 7)

tions, stated that good progress has been made in getting sulphuric acid and that there will probably be enough superphosphate. He also described the method being used in the allocation of nitrate of soda, urging especially that farmer-agent and farmer-dealer relationship be studied carefully by the industry and that every effort be made to distribute nitrate equitably. He stated that the supply of arsenicals would probably be sufficient to meet the demand.

E. L. Deal, Agricultural Adjustment Administration, pointed out that the southern region depends to a very large extent on fertilizers and presented a statement prepared by Dr. I. W. Duggan, director of the southern region, urging that nitrate of soda and mixed fertilizers be distributed so that all farmers will receive their fair share.

T. E. Milliman presided at the afternoon session, and following the talks there was a full discussion of many problems, most of which related to the distribution of nitrate of soda. The meeting was not adjourned until after 4 o'clock.

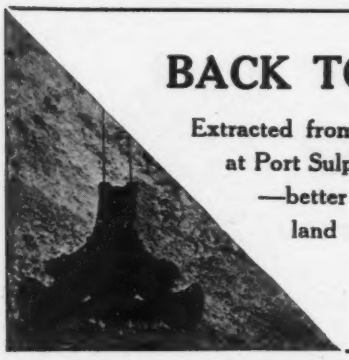
Philadelphia

The Philadelphia War Emergency Conference, which was held on March 13th, was well attended, there being more than 100 persons present, including agricultural officials from Maryland, Delaware, New Jersey, Pennsylvania, and New York. The Office of Price Administration was represented by T. E. Milliman, George Cushman, and John Scott; the Office of Agricultural Defense Relations by Dr. T. R. Moyer; and the War Production Board by Andrew Sullivan. Charles J. Brand presided as at the other meetings, introduced the officials present, and called on T. E. Milliman to outline the OPA policies with respect to fertilizers and fertilizer materials. As in all of the other meetings, Mr. Milliman's address was well received and there was a lively discussion of many questions. John Scott, OPA attorney, followed with an explanation of Temporary Price Regulation No. 1 and answered questions concerning it. He also urged especially that the complete regulation be sent to all agents and dealers.

Andrew Sullivan, production analyst, War Production Board, explained how priorities are determined and the procedures involved in obtaining priorities on materials. In the absence of P. H. Groggins, Office of Agricultural Defense Relations, who had attended the Rocky Mount, New Orleans, and Atlanta meetings, Dr. T. R. Moyer made a brief statement emphasizing especially the need for elimination of filler and reducing the number of grades sold to a minimum. H. R. Smalley stated that considerable progress has been made in the Middle Atlantic States both in eliminating filler and in reducing the number of grades, but that there is still room for much improvement in both directions. Mr. Brand read a telegram from Charles L. Sheldon of the Container Branch, WPB, stating that every effort would be made to supply fertilizer manufacturers with paper bags. T. E. Milliman stated that burlap and cotton are probably out of the picture in so far as fertilizer bags are concerned, and that from now on shipments will have to be made either in paper or in bulk. He stated that the Northeastern States have had more experience in the use of paper bags than other sections.

At the afternoon session S. B. Haskell, The Barrett Division, Allied Chemical & Dye Corp., made a statement concerning the nitrogen and domestic nitrate of soda situations: W. J. McCort spoke for Chilean Nitrate Sales Corp., and H. V. Cory made a brief statement on behalf of American Cyanamid Co. Prof. E. L. Worthen said that nitrogen is not so

(Continued on page 22)



BACK TO THE LAND

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MENTION "THE AMERICAN FERTILIZER" WHEN WRITING TO ADVERTISERS.

TO MAKE HIGH-ANALYSIS COMPLETE FERTILIZERS...

you must formulate with high-analysis materials!

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The manufacture of fertilizers containing 25 to 45% plant food calls for use of high-analysis materials such as Urea-Ammonia Liquor (UAL). Ammoniation of such grades with UAL makes possible:

Use of more dolomite, thus increasing content of calcium and magnesium and reducing acidity of the resultant mixture . . .

OR

Use of part ordinary superphosphate instead of all triple superphosphate, thus effecting a further saving in cost.

The nitrogen in UAL is completely available, leaching resistant, and relatively low in unit cost!

UAL-A UAL-B UAL-37

Specific information, giving typical formulas for making both high-analysis and single-strength mixtures with UAL, together with facts about the advantages and methods of cooling fertilizers for more rapid curing and superior condition, will be sent on request.

DUPONT
REG. U.S. PAT. OFF.

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AMMONIA DEPARTMENT · WILMINGTON, DELAWARE

Nitrate of Soda Allocation Policy Outlined

In a letter written on March 25th to Charles J. Brand, Executive Secretary of the National Fertilizer Association, H. H. Meyers, Chief of the Nitrogen Section, War Production Board, explained the policy of the Board with respect to the distribution of nitrate of soda. Allocations to fertilizer manufacturers are to be on basis of their nitrate of soda receipts during the 1940-41 season, but the Board desires to place emphasis on the use of this material for direct application rather than in mixed goods.

March 25, 1942.

Mr. Charles J. Brand, Executive Secretary,
National Fertilizer Association,
Washington, D. C.

Dear Mr. Brand:

As a means to a better understanding by fertilizer distributors concerning the policy of the War Production Board in the allocation of nitrate of soda during the current season, I take the liberty of re-iterating the principles and aims of the program:

(1) Allocation is accomplished by a monthly allotment for distribution through fertilizer companies to individual states. The War Production Board accepts the recommendations of the U. S. Department of Agriculture, which in turn consults the Land Grant Colleges and other state authorities as to crop requirements of the states for the month in question.

(2) Allocations to fertilizer manufacturers are made on the basis of their total nitrate receipts during the preceding fertilizer year (1940-41), including both bulk and bag nitrate.

(3) Every fertilizer manufacturer during the current fertilizer year will receive the same proportion of his previous year's receipts as accurately as it can be calculated in view of the Department of Agriculture's recommendations and the drastic decline in the supplies of cyanamid and Uramon.

(4) In accordance with the preference of the Department of Agriculture to have as much as possible of available nitrate moved to the farmers as such, unmixed with other materials, emphasis is placed by the War Production Board upon releasing maximum quantities of bagged nitrate for resale and as little as possible of bulk nitrate for mixing.

From the beginning of nitrate allocations, the War Production Board has expressed the desire for, and issued instructions to fertilizer manufacturers, to distribute nitrate of soda to farmers through agents and dealers, in the proportions and for the purposes for which it was allocated. A serious shortage exists, because of which it becomes imperative to have the nitrate of soda placed in the regions and upon the crops and with the farmers where it will do the most good in the production of crops vital to the war effort. The best means of guidance available to the War Production Board are the recommendations for crops and by states as issued by the U. S. Department of Agriculture after consultation with the several states.

We are accepting your much appreciated offer to distribute copies of this letter through the National Fertilizer Association. Each person or company receiving a copy is asked to give heed to it. We feel certain that all distributors of fertilizer will do their utmost to cooperate in distributing the amount of nitrate of soda available in as equitable a manner as possible. Each company receiving this letter is requested to have copies made and sent to all individuals connected with the company who may be in a position to further by means of equitable distribution of nitrate of soda, the crop goals of this nation at war.

Every fertilizer manufacturer is requested to send copies of this letter to all fertilizer agents and dealers in areas where nitrate of soda is used, together with local interpretations on how to apply this allocation plan by crops and areas, taking into account the dislocations caused by other nitrogen shortages, particularly cyanamid. Since state authorities have had a part in assisting the U. S. Department of Agriculture in making recommendations to the War Production Board where any uncertainty exists, fertilizer companies are invited to com-

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Founded 1834
Dependable for Fifty Years
All-Steel Self-Contained Fertilizer Mixing Units
Batch Mixers—Dry Batching
Pan Mixers—Wet Mixing
Swing Hammer and Cage Type Tailings Pulverizers
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MURIATE OF POTASH · 60% K_2O

MURIATE OF POTASH · 50% K_2O

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SULPHATE OF POTASH · 90/95% K_2SO_4

SUL-PO-MAG
AMERICA'S OWN
SULPHATE OF POTASH-MAGNESIA
40% K_2SO_4, 18.50% MgO

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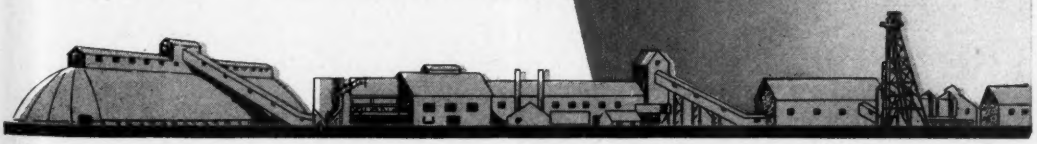

municate with the proper people in the states concerned, including the U. S. Department of Agriculture War Boards.

It is also recommended that fertilizer manufacturers request their agents and dealers to display in places of business copies of this letter and the communication addressed to such agents or dealers concerning it.

We realize that when a shortage of material exists, disputes are bound to arise with some justification on both sides of the issue. However, if the above recommendations are followed conscientiously from manufacturer to dealer to farmer, we believe that a minimum of occasions will arise for dissatisfaction. A nitrate-using farmer whose fertilizer agent has gone out of business should be taken care of proportionately with others. Favoritism on the part of agents or dealers, whereby their relatives, friends or favorite customers receive an undue proportion of nitrate of soda, is to be deplored as an interference with the vital part which food and crop production play in winning the war.

The War Production Board and the U. S. Department of Agriculture have chosen the fertilizer industry as the controlling instrument in distributing our shortened supplies of nitrate of soda. Fertilizer agents and dealers are a part of that industry. Any failure to make the program as effective as possible is a reflection upon the nation's trust in an industry's ability to carry out equitably a war program without cost to the government in manpower or money.

Sincerely yours,

H. H. MEYERS,
Chief, Nitrogen Section.

WAR EMERGENCY CONFERENCES

(Continued from page 18)

badly needed on dairy farms but is very essential to the fruit and truck grower. He feels that unless reasonable quantities of nitrogen can be used in mixed fertilizer it should not be included at all. George Cushman, Office of Price Administration, urged reduction of grades and elimination of filler by the fertilizer industry.

H. M. Albright, United States Potash Co., stated that there will be more refined potash available for 1942 than was available in 1941, and, barring strikes or transportation difficulties, supplies for the coming year will be entirely adequate.

Mr. Brand stated that, although sulphuric acid and superphosphate have been the cause of some concern, good progress in obtaining sulphuric acid has been made and there will probably be enough superphosphate to go around. T. E. Milliman discussed the allocation of nitrate of soda and urged that the agricultural colleges cooperate by making reasonable requests for their States. Many questions were asked and answered in so far as specific information was available.

WICKARD COMMENTS ON INTENTIONS TO PLANT

(Continued from page 11)

For livestock products progress reports are most encouraging. Egg production in February ran 15 per cent above a year ago. The goal is 13 per cent. Cold storage stocks for that month were 2,486,000 cases this year compared to 1,513,000 last year.

Still to come in are definite reports on acreages of commercial truck crops, canning crops, and farm gardens. But by and large, farmers are off to a good start in the Food-for-Freedom campaign. They can't afford to let up in their effort, nor can the Department of Agriculture let up in assisting them.

CLASSIFIED ADVERTISEMENTS

Advertisements for sale of plants, machinery, etc., and for help and employment, in this column, same type as now used, 60 cents per line, each insertion.

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LIVING COSTS STILL INCREASING

Living costs in February were one half of one per cent higher than in January, with prices again marked up for almost all lines of merchandise purchased. Rents changed very little except in a few defense areas. The Bureau of Labor Statistics cost of living index was 112.6 on February 15th, using average costs in 1935-1939 as 100. This was 11.7 per cent higher than in February of last year, and 14.2 per cent higher than in August, 1939.

PLANT CULTURE AND NITRIFICATION STUDIES WITH SLUDGE-ACID SUPERPHOSPHATE

(Continued from page 6)

second test, a more complete one was run in which the five superphosphates were compared in terms of the growth of barley, millet, oats, and sorghum. Results are given in Table 3.

Results of Greenhouse Tests

Results given in Table 2 fail to indicate that sludge-acid superphosphate is inferior to clear-acid superphosphate. While two of the sludge-acid superphosphates gave lower results (samples 1405 and 1414), the other two samples of sludge-acid superphosphate (1402 and 1403) produced higher yields than the clear-acid superphosphate. The average yield of the four sludge-acid superphosphates, relative basis, is 102.3. Further discussion of these data is hardly required.

With respect to the results shown in Table 3, if one were inclined to stress the decrease in barley yields, excepting that of sample 1402, it would be necessary to lay equal stress on the increased yields shown for the other plants. Taking the results as a whole, there were five cases where the sludge-acid superphosphates gave lower yields, as against eleven increases. These results do not indicate injurious effects.

Table 2.

Yields of Millet Obtained with Superphosphates Made with Clear and Sludge Sulphuric Acids

Superphosphate used in 6-12-6 mixture	Actual and Relative Weights of Millet (30 plants) (Moisture-free basis)	
	Actual Grams	Relative Per cent
No. 1315—Clear acid	17.0	100
No. 1402—Separated sludge acid	18.7	110 >
No. 1403—Processed sludge acid	18.4	108
No. 1405—Separated sludge acid	16.2	95.3
No. 1414—Separated sludge acid	16.3	96
No phosphorus (N-K only) ...	8.7	51.2

Nitrification Studies

The effect of superphosphates made with clear and sludge acids on the nitrification of ammonium sulphate was determined in laboratory experiments with a sandy loam soil.[6] The phosphates were applied at the rate of 50 milligrams of P_2O_5 per 100 grams of air-dry soil, equivalent to 1,000 pounds of P_2O_5 per acre 5 inches deep or approximately 2,000,000

[6] These experiments were kindly made by the Nitrogen Section, Division of Soil and Fertilizer Investigations, Bureau of Plant Industry.

Table 3.

Results with Barley, Millet, Oats, and Sorghum in Comparing Superphosphates Made with Clear and Sludge Sulphuric Acids

Type of superphosphate in 6-12-6 mixture	Actual and relative weights of test crops. Moisture-free basis							
	Barley		Millet		Oats		Sorghum	
	Actual Grams	Relative Per cent	Actual Grams	Relative Per cent	Actual Grams	Relative Per cent	Actual Grams	Relative Per cent
No. 1315 Clear acid	31.2	100.0	46.5	100.0	45.0	100.0	98.4	100.0
No. 1402 Separated sludge acid	32.3	103.5	46.2	99.4	49.3	109.5	93.4	94.9
No. 1403 Processed sludge acid	29.5	94.5	47.5	102.1	48.0	106.7	101.9	103.5
No. 1405 Separated sludge acid	30.5	98.0	51.4	110.5	48.1	107.0	103.4	105.0
No. 1414 Separated sludge acid	29.9	96.0	49.7	106.9	51.2	113.8	109.2	111.0
No phosphorus (N-K only)..	7.2	23.1	24.6	53.0	32.2	71.5	49.5	50.0

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See Page 4

pounds of soil. Ammonium sulphate was added at the rate of 20 milligrams of nitrogen per 100 grams of soil, and each culture contained 2 grams of calcium carbonate. The cultures, maintained at a moisture content of 20 per cent, were incubated at laboratory temperature.

In comparison with the monocalcium phosphate and the clear-acid superphosphate, the superphosphates made with separated sludge acid had, in general, no significant adverse effect on the nitrification of ammonium sulphate (Table 4). The superphosphate made with processed sludge acid (No. 1403) appeared, however, to depress nitrification slightly. The average conversions with all the sludge-acid superphosphates were 72.5, 73.0 and 68.5 per cent in 2, 4 and 6 weeks, respectively, compared to 74.0, 76.9 and 70.0 per cent with the clear-acid superphosphate.

Summary

In order to obtain information on the nutrient value of the phosphorus in sludge-acid superphosphate, greenhouse pot tests were carried out on Norfolk loamy fine sand, pH 5.4, with barley, millet, oats and sorghum. Four sludge-acid superphosphates were compared with a superphosphate made with clear sulphuric acid. All the superphosphates were made from Florida land pebble phosphate. Under the conditions of these tests, the sludge-acid superphosphates usually produced results that were not inferior to those obtained with clear-acid superphosphates.

The sludge-acid superphosphates were further compared with clear-acid superphosphates by means of nitrification studies on ammonium sulphate in soil cultures. To certain cultures sludge-acid superphosphate was added, to others clear-acid superphosphate. Both materials supplied the same quantity of phosphorus. The conversion of ammonium nitrogen to the nitrate form was practically the same over a 6-weeks period for both types of superphosphate. Measurements at intervals of 2, 4, and 6 weeks showed that the average conversions with the sludge-acid superphosphates were 98, 96.1, and 97.8 per cent of the conversion in the clear-acid superphosphate cultures.

Table 4.

Nitrification of Ammonia Sulphate in the Presence of Superphosphates Made with Clear and Sludge Sulphuric Acids

No.	Phosphate Type	P_2O_5 added to soil Mg.	N added to soil Mg.	Nitrification: 2 weeks N as nitrate Mg.	2 weeks Conversion of added N Per cent	4 weeks N as nitrate Mg.	4 weeks Conversion of added N Per cent	6 weeks N as nitrate Mg.	6 weeks Conversion of added N Per cent
	None	0	0	5.09	...	7.82	...	6.40	...
1277-C	Monocalcium phosphate*	25	0	5.80	...	7.82	...	6.08	...
1277-C	Monocalcium phosphate*	50	20	19.5	72.0	25.0	85.9	18.5	60.5
1315	Superphosphate, clear acid	50	20	19.9	74.0	23.2	76.9	20.4	70.0
1402	Superphosphate, separated sludge acid	50	20	20.0	74.5	22.7	74.4	20.2	69.0
1403	Superphosphate, processed sludge acid	50	20	18.9	69.0	21.4	67.9	18.8	62.0
1405	Superphosphate, separated sludge acid	50	20	19.2	70.5	21.4	67.9	20.8	72.0
1414	Superphosphate, separated sludge acid	50	20	20.3	76.0	24.2	81.9	20.6	71.0

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For Alphabetical List of Advertisers, see page 33.

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Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

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Chemical Construction Corp., New York City.

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Chemical Construction Corp., New York City.
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Barrett Division, The, Allied Chemical & Dye Corp., New York City.
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Duriron Co., Inc., The, Dayton, Ohio.
Fairlie, Andrew M., Atlanta, Ga.
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Hayward Company, The, New York City.
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Baker & Bro., H. J., New York City.
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International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
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NOZZLES—Spray
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PACKING—For Acid Towers
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POTASH SALTS—Dealers and Brokers
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Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
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International Minerals & Chemical Corporation, Chicago, Ill.
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Monarch Mfg. Works, Inc., Philadelphia, Pa.

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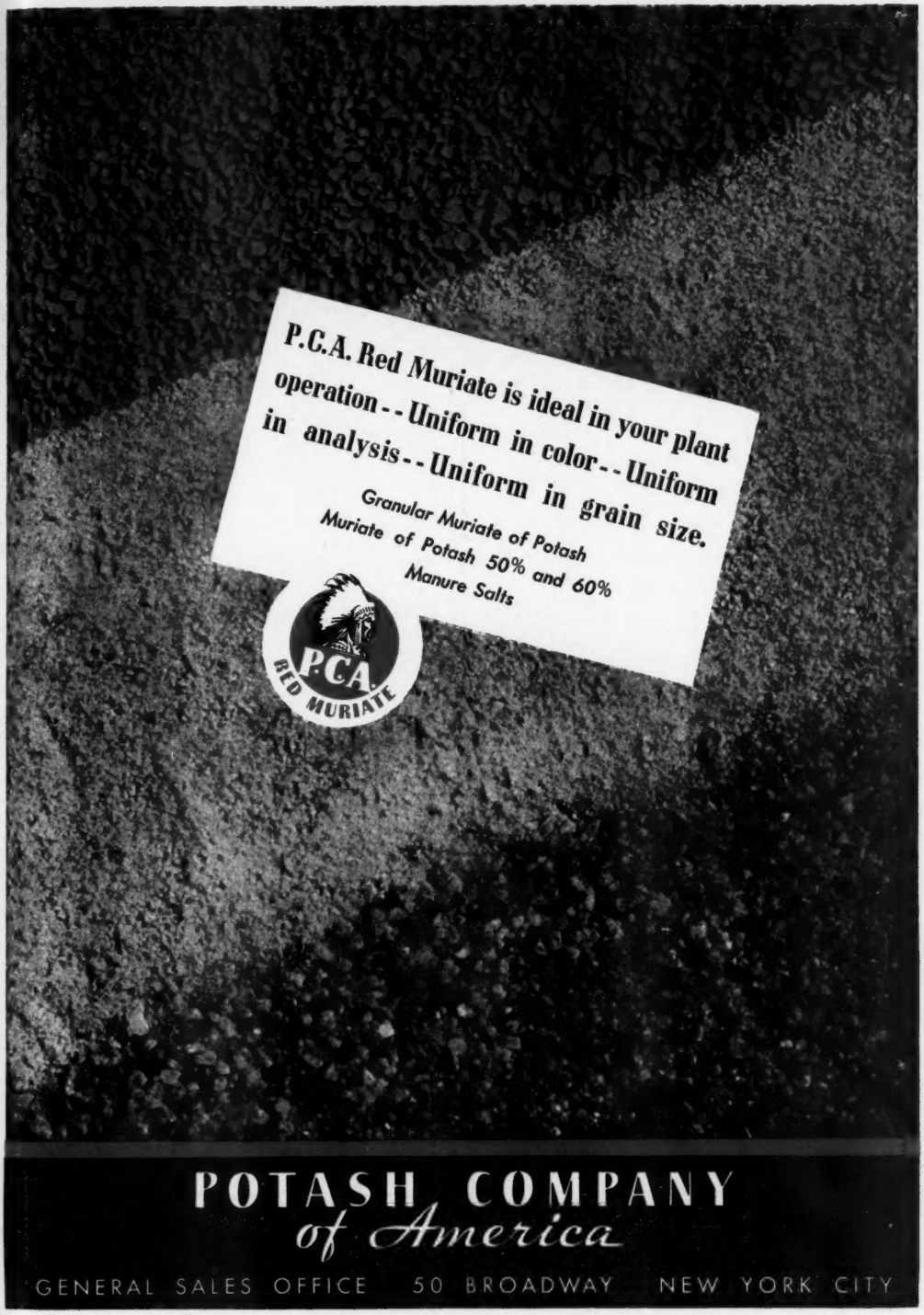
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